

REMARKS

In the last Office Action, the Examiner withdrew claims 5-7 from further consideration as being directed to a non-elected invention. Claims 1-3 were objected to as containing an informality. Claims 1 and 4 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Publication No. US 2002/0175375 to Kunikiyo ("Kunikiyo '375") in view of U.S. Patent No. 6,753,563 to Havemann. Claims 2-3 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kunikiyo '375 in view of Havemann and further in view of U.S. Patent No. 6,545,318 to Kunikiyo ("Kunikiyo '318").

In accordance with the present response, the specification has been suitably revised to correct informalities and provide antecedent basis for the claim language. Original independent claim 1 has been amended to further patentably distinguish from the prior art of record. Claims 1-4 have also been amended to improve the wording, overcome the Examiner's objection, and bring the claims into better conformance with U.S. practice. Non-elected claims 5-7 have been canceled without prejudice or admission and subject to applicant's right to file a continuing application to pursue the subject matter of the non-elected claims. New claims 8-16 have been added to provide a fuller scope of coverage. A new abstract which more clearly reflects the

invention to which the amended and new claims are directed has been substituted for the original abstract.

In view of the foregoing, applicant respectfully submits that the objection to the claims has been overcome and should be withdrawn.

Applicant requests reconsideration of his application in light of the following discussion.

Brief Summary of the Invention

The present invention is directed to a semiconductor device.

As described in the specification (pgs. 1-2), conventional semiconductor devices, such as MOS-type transistors, have been unable to meet strict requirements for depths of contact holes and corresponding high concentration diffusion layers forming drain/source regions of the semiconductor devices.

The present invention overcomes the drawbacks of the conventional art. Fig. 1-4I show an embodiment of a semiconductor device according to the present invention embodied in the claims. The semiconductor device has a semiconductor substrate 201 having a first conductivity type, a field oxide film 208 disposed on the semiconductor substrate 201, and a gate electrode 205 surrounded by the field oxide

film 208 and disposed on the semiconductor substrate 201 through a gate oxide film 211. A low concentration source/drain region 4 is disposed in a region over the semiconductor substrate 201 surrounded by the field oxide film 208 and the gate electrode 205. The low concentration source/drain region 4 has a second conductivity type opposite to the first conductivity type. An interlayer film 213 is disposed over the semiconductor substrate for electrically isolating the gate electrode 205 and the low concentration source/drain region 4 from wirings disposed on the interlayer film 213. Etched contact holes 210 extend through the interlayer film 213 for electrically connecting the gate electrode 205 and the low concentration source/drain region 4 with the wirings disposed on the interlayer film 213. A nitride film 601 is disposed under the interlayer film 213 for preventing the semiconductor substrate 201 from being overetched during formation of the etched contact holes 210 in the interlayer film. High concentration diffusion layers 203 having the second conductivity type are disposed only in respective portions of the low concentration source/drain region 4 directly under the respective contact holes 210.

By the foregoing construction, the present invention provides a semiconductor device having high concentration diffusion layers which are prevented from extending beyond

respective regions in the low concentration source/drain region directly under the respective contact holes, thereby achieving a semiconductor device with high operational performance and reliability.

Traversal of Prior Art Rejections

Claims 1 and 4 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kunikiyo '375 in view of Havemann. Applicant respectfully traverses this rejection and submits that the combined teachings of Kunikiyo '375 and Havemann do not disclose or suggest the subject matter recited in amended claims 1 and 4.

Amended independent claim 1 is directed to a semiconductor device and requires a semiconductor substrate having a first conductivity type, a field oxide film disposed on the semiconductor substrate, a gate electrode surrounded by the field oxide film and disposed on the semiconductor substrate through a gate oxide film, and a low concentration source/drain region disposed in a region over the semiconductor substrate surrounded by the field oxide film and the gate electrode, the low concentration source/drain region having a second conductivity type opposite to the first conductivity type. Amended claim 1 further requires an interlayer film disposed over the semiconductor substrate for

electrically isolating the gate electrode and the low concentration source/drain region from wirings disposed on the interlayer film, a plurality of etched contact holes extending through the interlayer film for electrically connecting the gate electrode and the low concentration source/drain region with the wirings disposed on the interlayer film, a nitride film disposed under the interlayer film for preventing the semiconductor substrate from being overetched during formation of the etched contact holes in the interlayer film, and a plurality of high concentration diffusion layers having the second conductivity type and disposed only in respective portions of the low concentration source/drain region directly under the respective contact holes. No corresponding structural combination is disclosed or suggested by the combined teachings of Kunikiyo and Havemann.

The primary reference to Kunikiyo '375 discloses a semiconductor device having a semiconductor substrate 15, a gate electrode 6, a low concentration source/drain region 19n, an interlayer film 27, contact holes 25b formed in the interlayer film 27, and a high concentration diffusion layer 18n formed in the low concentration source/drain region 19n where the contact holes 25 are formed (Fig. 2).

However, Kunikiyo '375 does not disclose or suggest high concentration diffusion layers disposed only in respective portions of the low concentration source/drain

region directly under the respective contact holes. With reference to the embodiment of the present invention shown in Fig. 1, the high concentration diffusion layers 203 are disposed only in respective portions of the low concentration source/drain region 204 directly under the respective contact holes 210. Stated otherwise, in the present invention the high concentration diffusion layers 203 do not extend beyond a region of the low concentration source/drain region 204 disposed directly under the respective contact holes 210.

In contrast, in Kunikiyo '375 the high concentration diffusion layer 18n is not restricted only to a region of the low concentration source/drain region 19n directly under the contact holes 25a. Stated otherwise, the high concentration diffusion layer 18n extends beyond such region directly under the contact holes 25a (i.e., the high concentration diffusion layer 18n also extends toward the right and left sides of the contact holes 25a in Fig. 2).

As recognized by the Examiner, Kunikiyo '375 also does not disclose or suggest the nitride film and corresponding function recited in amended independent claim 1. The Examiner cited the secondary reference to Havemann for its disclosure of a nitride film for the purpose of preventing damage to a semiconductor substrate during formation of a contact hole. However, Havemann does not disclose or suggest

the structural combination of the semiconductor device recited in amended claim 1, including high concentration diffusion layers disposed only in respective portions of the low concentration source/drain region directly under the respective contact holes. Since Havemann does not disclose or suggest this structural feature, it does not cure the deficiencies of Kunikiyo '375. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

Claim 4 depends on and contains all of the limitations of amended independent claim 1 and, therefore, distinguishes from the references at least in the same manner as claim 1.

In view of the foregoing, applicant respectfully requests that the rejection of claims 1 and 4 under 35 U.S.C. §103(a) as being unpatentable over Kunikiyo '375 and Havemann be withdrawn.

Claims 2-3 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kunikiyo '375 in view of Havemann and further in view of Kunikiyo '318. Applicant respectfully traverses this rejection and submits that the combined teachings of Kunikiyo '375, Havemann and Kunikiyo '318 do not disclose or suggest the subject matter recited in amended claims 2-3.

Kinikiyo '375 in view of Havemann does not disclose or suggest the subject matter recited in amended independent claim 1 as set forth above for the rejection of claims 1 and 4 under 35 U.S.C. §103(a). Claims 2-3 depend on and contain all of the limitations of amended independent claim 1 and, therefore, distinguish from the references at least in the same manner as claim 1.

The Examiner cited the reference to Kunikiyo '318 for its disclosure of a low concentration source/drain region and a high concentration diffusion layer having the impurity concentrations within the ranges recited in claims 2-3. However, Kunikiyo '318 does not disclose or suggest the structural combination of the semiconductor device recited in amended claim 1, from which claims 2-3 depend, including high concentration diffusion layers disposed only in respective portions of the low concentration source/drain region directly under the respective contact holes. Since Kunikiyo '318 does not disclose or suggest this structural feature, it does not cure the deficiencies of Kunikiyo '375 as modified by Havemann. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicant respectfully requests that the rejection of claims 2-3 under 35 U.S.C. §103(a) as being unpatentable over Kunikiyo '375 in view of Havemann and further in view of Kunikiyo '318 be withdrawn.

Applicant respectfully submits that newly added claims 8-16 also patentably distinguish from the prior art of record.

New independent claim 9 is directed to a semiconductor device and requires a semiconductor substrate having a first conductivity type, a gate insulating film disposed on a surface of the semiconductor substrate, a gate electrode disposed on the gate insulating film, an a plurality of low concentration diffusion layers disposed on the surface of the semiconductor substrate on opposite sides of the gate electrode, the low concentration diffusion layers having a second conductivity type different from the first conductivity type. Claim 9 further requires an interlayer film disposed over the semiconductor substrate electrically isolating the gate electrode and the low concentration diffusion layers from wiring disposed on the interlayer film, a plurality of contact holes extending through the interlayer film for electrically connecting the gate electrode and the low concentration diffusion layers with the wirings disposed on the interlayer film, and a plurality of high concentration diffusion layers

having the second conductivity type and disposed only in portions of the respective low concentration diffusion layers directly under the respective contact holes. No corresponding structural combination is disclosed or suggested by the prior art of record as set forth above for amended independent claim 1.

New claims 8 and 10-16 depend on and contain all of the limitations of amended independent claim 1 and new independent claim 9, respectively, and, therefore, distinguish from the references at least in the same manner as claims 1 and 9.



In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

ADAMS & WILKS
Attorneys for Applicant

By:

Bruce L. Adams
Reg. No. 25,386

50 Broadway - 31st Floor
New York, NY 10004
(212) 809-3700

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Debra Buonincontri

Name

Debra Buonincontri

Signature

July 5, 2005

Date